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(54) Title of the invention A coated fabric

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Specification

## 1. Title of the Invention

A coated fabric

## 2. Scope of Claims

1. A coated fabric which is characterized in that rigid fine spherical particles (3) are arranged on the surface of a coated film (2) formed on one face of a fabric (1) such that they project from the surface of the coated film (2).

2. A coated fabric according to Claim 1 which is characterized in that the fine spherical particles (3) are arranged such that the planar area of rigid fine spherical particles projecting from the surface is from 7 to 50% as a proportion of the coated film (2) area.

3. A coated fabric according to Claim 1 or Claim 2 which is characterized in that, as the rigid fine spherical particles (3), there are used particles of particle diameter 1 to 100 μm.

## 3. Detailed Description of the Invention

[Industrial Field of Application]

This invention relates to a coated fabric where a coated film is formed on one face of a fabric in order to confer, for example, water repellency on a fabric to be used as the starting material for clothing and the like, and it has the aim of enhancing the durability of this coated film in terms of abrasion, etc.

[Prior-Art and Problem therewith]

In conventional coated fabrics where a coated film is formed on one face of the fabric, said coated film is formed so as to be light and flexible in order that it does not impair the flexibility, etc, of the fabric.

However, such coated films have poor durability in terms of abrasion and the like, so in cases where conventional coated fabrics formed in this way have been used as the starting material for survival suits, fishermen's raincoats and like, which are employed under severe working conditions, there has been the problem that the coated film is readily worn-away or separates-away, and cannot withstand prolonged used.

[Means for Resolving the Problem]

The present invention has been made to try to resolve this problem associated with conventional coated fabrics, and according to the present invention the coated fabric is given a structure of the following kind so that the coated film is provided with sufficient durability in terms of abrasion and the like.

In the present invention, rigid fine spherical particles (3) are arranged on the coated film (2) formed on one face of fabric (1) in such a way that they project from the surface of the coated film (2).

Here, just as in the conventional case, the coated film (2) formed on one face of the fabric (1) is preferably light and flexible so as not to impair the flexibility,

etc, of fabric (1), and the material thereof is normally polyurethane, chloroprene or the like.

Furthermore, for the rigid fine spherical particles (3), there is used a synthetic resin, glass, ceramic or the like which has been produced in a fine spherical shape and, normally, particles of diameter in the range 1 to 100 μm are used. The reason why particles of diameter in the range 1 to 100 μm are used is because in the case of a particle diameter of less than 1 μm, the particles are too small and they are difficult to produce in a spherical shape. Furthermore, it is difficult to arrange them in such a way that they project from the surface of the coated film (2). On the other hand, in the case where the particle diameter is larger than 100 μm, the particles are too large and the feel of the fabric, etc, becomes unpleasant. Now, it is further preferred that there be used particles of particle diameter in the range 5 to 30 μm.

Again, in arranging such fine spherical particles (3) so that they project from the surface of the coated film (2), if the amount of the fine spherical particles provided is too great, the flexibility of the coated film (2) is impaired by said fine spherical particles (3), while if the amount of the fine spherical particles (3) provided is too small, it is not possible to adequately raise the durability of the coated film (2) in terms of abrasion and the like. Hence, preferably, arrangement of the particles is carried out such that the planar area of the regions where these rigid fine spherical particles (3) project from the surface is from 7 to 50% as a proportion of the coated film (2) area. More preferably, from the point of view of fully

enhancing the durability in terms of abrasion and the like without impairing the flexibility of the coated film (2), arrangement of the particles should be such that the planar area of fine spherical particles projecting from the surface of coated film (2) is a proportion comprising 10 to 25% of the area.

[Action]

Thus, in the coated fabric relating to the present invention, since there are arranged rigid fine spherical particles (3) in such a way that they project from the surface of the coated film (2), abrasion of the coated film (2) takes place via the rigid fine spherical particles (3) projecting from the surface of said coated film (2), and the coefficient of static friction at the surface of coated film (2) is therefore markedly reduced and large frictional forces are not applied to the coated film (2).

[Examples]

Below, examples of the present invention are explained based on the drawings.

In the example shown in Figure 1, a light and flexible coated film (2) of polyurethane or chloroprene is formed on one face of fabric (1), and on this there are arranged, along with a film coating (31), rigid fine spherical particles (3) composed of synthetic resin, glass, ceramic or the like, in such a way that they project from the surface of coated film (2). That is to say, in this example, fine spherical particles (3) as described above are incorporated into a suitable resin liquid, and then this resin liquid is applied onto the

surface of coated film (2) and dried so that, along with film coating (31), fine spherical particles (3) are arranged projecting from the surface of coated film (2). Here, the film coating (31) formed on the surface of coated film (2) preferably has flexibility in the same way as coated film (2), and normally there will be used polyurethane or the like.

Furthermore, in the example shown in Figure 2, in arranging the rigid fine spherical particles (3) so that they project from the surface of coated film (2) formed on one face of fabric (1), said fine spherical particles (3) are directly embedded in the surface of coated film (2) by static electricity or the like, in such a way that a part of these fine spherical particles (3) projects from the surface of the coated film (2).

However, the means for arranging the rigid fine spherical particles (3) so that they project from the surface of the coated film (2) is not restricted to the examples given above and, for example, it is also possible to apply an adhesive agent to the surface of the coated film (2) and then scatter the fine spherical particles (3) on top, so that said fine spherical particles are arranged projecting from the surface of the coated film (3). In short, the fine spherical particles (3) are made to project from the surface of the coated film (2) in such a way that they do not separate from the coated film (2).

Next, some specific examples are provided to demonstrate that the coated film on a coated fabric formed in this way is outstanding in its durability in terms of abrasion and the like.

[Example 1]

In this example, there was employed as the fabric a 210 yarn nylon taffeta, comprising nylon 70d-68 filament multifilament yarn, which was dyed and subjected to finish setting, after which it was immersed in a fluorine-based waterproofing liquid, then mangled to give a 60% take-up of the waterproofing liquid by fabric weight, followed by drying at 80°C, and then finish setting was carried out for 40 seconds at 160°C to confer water repellency on the fabric. Now, the conferring of water repellency on the fabric was to prevent penetration of the fabric by the resin liquid used in the formation of the coated film, when producing the coated film as follows.

To one face of the fabric on which water repellency had been conferred in this way there was applied, at a coverage of 30 g/m$^2$, an undercoating resin liquid of proportions comprising 100 parts of Crisbon 5816EL [a Dainippon Ink & Chemicals Inc. product] in which the chief component is polyurethane, 5 parts of the isocyanate crosslinking agent Coronate HL [a Dainippon Ink & Chemicals Inc. product] and 45 parts of methyl ethyl ketone, and after forming the undercoating layer there was applied on top, at a coverage of 150 g/m$^2$, a resin liquid of proportions comprising 100 parts of Crisbon 3140 [a Dainippon Ink & Chemicals Inc. product] in which the chief component is polyurethane, 12 parts of Dilac White which is a blend of titanium white and resin [a Dainippon Ink & Chemicals Inc. product], 40 parts of methyl ethyl ketone, and 10 parts of dimethylformamide, to form a coated film in which

polyurethane was the chief component. Here, the reason for the prior application of the undercoating resin was so that the coated film was completely affixed to the fabric.

Furthermore, on the coated film formed in this way, there was applied, at a coverage of 25 g/m$^2$, a resin liquid formed by adding 25 parts of Nylon PK-500 [a Toray Industries product], which comprises fine spherical particles of nylon, to 35 parts of Crisbon 7667EL [a Dainippon Ink & Chemicals Inc. product] in which the chief component is polyurethane, 45 parts of methyl ethyl ketone and 15 parts of dimethylformamide. This was dried at 80°C and stentering then carried out for 30 seconds at 160°C. In this way, there was obtained a coated fabric with a coated film, on the surface of which were provided a film coating together with fine spherical particles which projected out from the surface of the coated film.

A comparison was made of the coefficient of static friction of the coated film, the resistance to heat-induced tackiness and the rubbing resistance strength, using the coated fabric from Example 1 where rigid fine spherical particles had been arranged projecting from the coated film surface, and a coated fabric where only the coated film was formed and no fine spherical particles were provided.

Firstly, in order to compare the coefficient of static friction of these coated films, measurements were carried out using a Coefficient of Static Friction Measurement Instrument (Type Hedon 10) [produced by Shinto Kagaku K.K.]. As a result, it was found that

while the coefficient of static friction was 0.684 in the case of the coated film where no fine spherical particles were provided, it was 0.412 in the case of the coated film where fine spherical particles had been arranged, and so the coefficient of static friction of the coated film in the latter case was about 1/2 that in the case where only a coated film was formed, and thus large frictional forces do not act on the coated film.

Furthermore, with regard to the resistance to heat-induced tackiness of the coated film, there was employed roughly the same method as in the tack-free test of JIS-K-6772. Coated fabrics were mutually superimposed one on another with their coated films facing, and a 3 kg load was applied over a 60 mm square region thereof. The fabrics were left in this state for 24 hours at a temperature of 80°C, after which the load was removed and the fabrics allowed to cool. The superimposed coated fabrics were then separated and the state of the coated films inspected. As a result, it was found that in the case where only a coated film had been formed, there was mutual adhesion of the superimposed coated films and when the coated fabrics were separated some coated film separated from the fabric. In contrast, there was absolutely no change in the case where fine spherical particles had been arranged on the coated film and, in terms of the resistance to heat-induced tackiness of the coated film, it was superior to the case where only the coated film had been formed.

Again, with regard to the rubbing resistance strength of the coated film, there was employed roughly the same method as in the Scott method of JIS-L-1096. The coated fabric was fixed to a Scott tester and, using a pressing

load of 1 Kgf, forwards/backwards abrasion was performed in the bias direction. As a result it was found that, in the case of the coated fabric where only a coated film had been formed, the coated film exhibited separation from the fabric as a result of 1000 passes in the abrasion test. In contrast, there was no separation of the coated film even with 3000 passes in the case of the coated film where fine spherical particles had been provided, so that in terms of the rubbing resistance strength of the coated film too it was outstanding.

[Example 2]

In this example there was used, as the fabric, #4281 [a Toray Industries product name] which is a 420 denier nylon woven fabric with an Oxford weave.

To one face of this fabric, there was applied, at a coverage of 60 g/m$^2$, an undercoating resin liquid of proportions comprising 100 parts of Neoprene WRT [a DuPont Far East Co. product] in which the chief component is chloroprene, 0.5 parts of stearic acid, 30 parts of carbon, 5 parts of zinc white, 4 parts of magnesium oxide, 1.5 parts of the vulcanizing accelerator Accelerator 22 [an Ouchi Kagaku K.K. product], 2 parts of the isocyanate crosslinking agent Crisbon NX [a Dainippon Ink & Chemicals Inc. product] and 300 parts of toluene, and then drying was carried out at 80°C to form a film of undercoating resin. Subsequently, there was applied on top, at a coverage of 250 g/m$^2$, a resin liquid of proportions comprising 100 parts of the aforesaid Neoprene WRT, 0.5 parts of stearic acid, 35 parts of carbon, 5 parts of zinc white, 3.5 parts of magnesium oxide, 1.5 parts of the aforesaid

Accelerator 22, 20 parts of calcium carbonate and 290 parts of toluene, and this was then dried at 80°C, followed by 20 minutes vulcanizing at 155°C to form a coated film in which chloroprene was the chief component.

Furthermore, on the surface of this coated film, there was applied, at a coverage of 35 g/$m^2$, a resin liquid containing 100 parts of the aforesaid Crisbon 3140, 45 parts of a solvent mixture of methyl ethyl ketone and dimethyl formamide, and 25 parts of the aforesaid Nylon PK-500 which comprised fine spherical particles of nylon. This was dried at 120°C and there was obtained a coated fabric, on the surface of the coated film of which were arranged a film coating together with fine spherical particles which projected out from the surface of the coated film.

In the same way as in Example 1, a comparison was made of the coefficient of static friction of the coated film and the rubbing resistance strength, using the coated fabric from Example 2 where rigid fine spherical particles had been arranged projecting from the coated film surface, and a coated fabric where only the coated film was formed and no fine spherical particles were provided.

Firstly, when a comparison was made of the coefficient of static friction of these coated films, it was found that while the coefficient of static friction was 0.704 in the case of the coated film where no fine spherical particles had been provided, it was 0.315 in the case of the coated film where fine spherical particles had been arranged, and so the coefficient of static friction was

less than 1/2 that in the case where only a coated film was formed. Thus, in the same way as in the case of Example 1 above, large frictional forces do not act on the coated film.

Furthermore, when a comparison was made of the rubbing resistance strength, in the case of the coated fabric where only a coated film had been formed it was found that, while there was no separation of the coated film from the fabric with 500 passes in the abrasion test, the coated film did show separation from the fabric as a result of 1000 passes in the abrasion test. In contrast, just as in the case of Example 1, there was no separation of the coated film even with 3000 passes in the case of the coated film where fine spherical particles had been provided, so that in terms of the rubbing resistance strength of the coated film too it was outstanding.

[Effects of the Invention]

As explained in detail above, in the coated fabric relating to the present invention, rigid fine spherical particles project from the surface of the coated film formed on one face of the fabric, and abrasion, etc, of the coated face is effected via these projecting fine spherical particles.

Hence, in the case of the coated fabric relating to the present invention, the coated film is not directly abraded and worn away, as in the case of a conventional coated fabric where only a coated film is formed, so wear of the coated film by abrasion is considerably reduced and, furthermore, the coefficient of static friction of the coated film is markedly lowered compared

to the conventional case. Thus, there is no separation of the coated film due to the large frictional forces which act on a conventional coated film.

Thus, in the case of the coated fabric relating to the present invention, the durability of the coated film in terms of abrasion and the like is markedly enhanced compared to conventional coated fabrics, so it can withstand prolonged usage. Furthermore, it is ideal for use as a starting material for survival suits and fishermen's raincoats which are employed under severe working conditions.

Moreover, when particles of particle diameter 1 to 100 µm are used as the rigid fine spherical particles, as well as these fine spherical particles readily being arranged so that they project from the surface of the coated film, it is possible to enhance the durability of the coated film without impairing the feel of the fabric by said fine spherical particles.

Furthermore, by arranging the fine spherical particles on the coated film in such a way that the planar area of the fine spherical particles projecting from the surface of the coated film is from 7 to 50% as a proportion of the area, it is possible to fully enhance the durability of the coated film to abrasion and the like without impairing the flexibility of the coated film by said fine spherical particles.

## 4. Brief Explanation of the Drawings

The drawings show practical examples of the present invention. Figure 1 is a sectional view of an example where there is formed a film coating such that rigid fine spherical particles project from the surface of the coated film; and Figure 2 is a sectional view of an example where the rigid fine spherical particles are directly embedded at the surface of the coated film.

Explanation of the numerical codes

(1) ... fabric (2) ... coated film

(3) ... fine spherical particles

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Figure 1

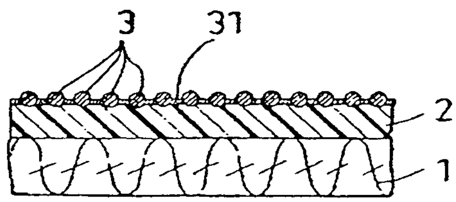


Figure 2